ISSN 0821-9427

DEVELOPMENT OF PLANTATIONS ON CROWN LANDS

Planted 1976, Assessed 1986

NEW BRUNSWICK Natural Resources and Energy / Ressources naturelles et Énergie NOUVEAU-BRUNSWICK

This publication is jointly funded under the Canada/New Brunswick Forest Renewal Agreement

Government of Canada / Gouvernement du Canada
Canadian Forestry Service / Service canadien des forêts

92-05967/

DEVELOPMENT OF PLANTATIONS ON CROWN LANDS (Planted 1976, Assessed 1986)

"This publication is jointly funded under the Canada/ New Brunswick Forest Renewal Agreement"

Copies Available by Contacting:
Timber Management Branch
Department of Natural Resources and Energy
P. O. Box 6000
Fredericton, N.B.
E3B 5H1

ABSTRACT

Sample plots established (in 1981) in 1976 plantations were remeasured in 1986. Height and diameter measurements from seventy six sample plots were analysed to show height and diameter (dbh) of planted trees.

Measurements were also recorded for the height, diameter (dbh) and density of natural conifer reproduction and hardwood competition.

TABLE OF CONTENTS

	Page
Abstract	i
Introduction	1
Methods	1
Results	2
Summary	4
Table 1. Development of Selected 1976 Bare Root Plantations Assessed 1986.	5
Table 2. Development of Selected 1976 Paper Pot Plantations Assessed 1986.	6
Table 3. Species Development of Selected 1976 Plantations Assessed in 1986.	7
Table 4. License Averages of Selected 1976 Plantations Ten Years After Planting.	8
Table 5. Comparison of Height Growth of the Fifth and Tenth Year Assessments.	9
Table 6. Plantation Performance by License Ten Years After Planting.	10

INTRODUCTION

Monitoring plantation development with permanent sample plots commenced in 1980. Since that time plantations of most planted species, and all forest licenses have been sampled. However, not all species occur on each license.

To date planatations of white pine and Norway spruce have not been sampled.

The number of sample plots established totaled over 1 500 by 1986. Seventy six plots established in 1976 plantations were remeasured in 1986.

The primary use of the data collected will be to provide yield information to support the wood supply analysis.

All measurement data was collected and analysed by the Timber Management Branch, Department of Natural Resources and Energy, Province of New Brunswick.

METHODS

Permanent sample plots of 8 metre radius (201 m^2 area) were established in 1976 plantations as suggested by Krause 1979[1]. Sample plots containing less than thirty one (31) planted trees were not remeasured in 1986.

---

[1] H. H. Krause, 1979. Development and Yield Projections in Forest Plantations, A Proposal for Growth Monitoring in N.B. D.N.R. Plantations.

On each sample plot, planted trees were identified with aluminum tags and their height and diameter (dbh) was recorded. The height and diameter (dbh) of natural conifers more than 50 cm high was recorded by species. Diameters of less than 3.0 cm dbh were not recorded.

Hardwood species taller than one (1) metre were recorded on each 8 metre radius plot if fewer than 100 trees were present. When more than 100 trees were present, hardwoods were tallied on 4 subplots of 1.0 metre radius. Trees larger than 3.0 cm dbh were also recorded on the 8.0 metre radius plot in the latter case.

A soil pit was excavated near a sample plot to provide an estimate of soil drainage. A visual estimate of ground vegetation, slope and aspect were also recorded for the site.

Damage to planted trees was recorded both within and surrounding the sample plot according to its type, intensity and distribution. A more detailed account of methods can be obtained from the field manual.[1]

RESULTS

The average diameter of planted trees ten years after plantation establishment was 4.83 cm at breast height with a corresponding average height of 2.72 metres (Table 4). Jack pine was largest in height and diameter followed by black spruce and white spruce.

---

[1] Instructions for Establishment of Sample Plots for 10th Year Plantation Development Assessment. Dept. of Natural Resources and Energy (1986).

The largest diameter jack pine (6.79 cm) was recorded on the York License. The poorest development of jack pine (3.50 cm) occurred on the Upper Miramichi License. Black spruce showed its best development on the York License and was poorest on the Upsalquitch License. White spruce was sampled only on the Carleton and Restigouche-Tobique Licenses with the best diameter growth occuring on the Restigouche-Tobique License and the largest height growth on the Carleton License. (Table 4)

Comparison of height growth with the 5th year plantation assessment data (Table 5) shows that white and black spruce paper pots have performed slightly better than jack pine. Whereas jack pine bare root stock attained a greater height than white and black spruce bare root stock.

Natural softwoods contribute to plantation density both positively and negatively. Species such as black spruce were desireable where the density of planted stock was low due to poor survival. However, in many plantations excessive natural conifer invasion, especially balsam fir, was not considered beneficial because they create an over stocked condition requiring expensive spacing treatment. As well, balsam fir is highly susceptible to budworm damage. Table 6 shows that when total density was considered forty-five (45) percent of the sampled area had excessive stocking (ie. more than 3000 trees per hectare) of conifers.

Another undesirable contribution to plantation stocking was excessive (more than 500 trees per hectare of trees above critical height) numbers of hardwood stems. This condition was present on seventy-six (76) percent of the sample area (Table 6). Natural hardwood densities up to thirty thousand (30 000) trees per hectare were recorded (Table 1 & 2) on seventy-five (75) percent of the sample area.

SUMMARY

Crown Land plantations established in 1976 and remeasured in 1986 were meeting minimum density standards of 1500 trees per hectare. Many plantations exceed the 5th year density criteria of 3000 total stems (all species) per hectare.

Density of competing hardwoods was more than 500 trees per hectare on more than three quarters of the sample area.

TABLE 1
DEVELOPMENT OF SELECTED 1976
BARE ROOT PLANTATIONS ASSESSED 1986
10TH YEAR REPORT

SILVICULTURE TREATMENT NUMBER	PLANTATION NAME	AREA HA.	PLANTED SOFTWOOD		ALL NATURAL SOFTWOOD			ACCEPTABLE[2] NATURAL SOFTWOOD			ALL NATURAL HARDWOOD			NATURAL HARDWOOD COMPETITION[3]		
			AVG. HGT. (m)	AVG. DBH (cm)	AVG. DEN-SITY[1]	AVG. HGT. (m)	AVG. DBH. (cm)	AVG. DEN-SITY	AVG. HGT. (m)	AVG. DBH (cm)	AVG. DEN-SITY	AVG. HGT. (m)	AVG. DBH (cm)	AVG. DEN-SITY	AVG. HGT. (m)	AVG. DBH (cm)
103000476BP1	STEWART GULCH N.	185	3.09	5.3	83	1.97	5.0	0	0.00	0.0	1790	3.78	6.9	696	4.73	7.0
203T00976BP4	E. SIX MILE	45	2.57	4.2	2155	2.55	6.6	564	5.30	7.7	116	1.94	4.1	17	4.51	4.1
306T00176BP1	NEVERS BROOK	107	3.37	4.8	746	1.06	0.0	0	0.00	0.0	2586	1.38	0.0	0	0.00	0.0
307001576BP1	SHEPODY ROAD	87	2.12	3.6	124	1.61	5.8	0	0.00	0.0	2959	1.79	6.5	647	2.62	6.5
307001676BP1	SHEPODY ROAD	126	2.61	4.1	99	0.71	0.0	0	0.00	0.0	13528	1.63	3.3	1592	3.29	3.3
307T00476BP1	COLES ISLAND	20	3.80	5.4	99	1.91	0.0	0	0.00	0.0	398	1.68	0.0	0	0.00	0.0
406000176BP1	NICHOLL LAKE	29	3.40	4.6	0	0.00	0.0	0	0.00	0.0	348	1.53	0.0	0	0.00	0.0
406000276BP1	NICHOLL LAKE	13	3.78	4.9	0	0.00	0.0	0	0.00	0.0	1542	1.61	0.0	0	0.00	0.0
509000976BP1	LITTLE WAPSKE	32	2.19	3.8	373	1.21	0.0	0	0.00	0.0	4103	2.96	4.0	1716	3.80	4.0
510001176BP1	MOOSE BK	25	2.21	4.1	796	2.84	5.7	50	3.94	8.1	6764	2.14	0.0	3581	2.55	0.0
510T00876BP4	EIGHT MILE BK	97	2.33	3.9	647	1.69	6.2	10	2.46	0.0	1010	2.25	3.9	607	3.99	3.9
510T00876BP5	EIGHT MILE BK	97	1.12	3.4	597	2.58	4.8	17	2.48	0.0	3647	2.21	3.6	2852	2.30	3.6

1 DENSITY IN TREES PER HECTARE.
2 ACCEPTABLE IS DEFINED IN APPENDIX 9, PAGE 65 OF THE FOREST MANAGEMENT MANUAL. ALSO REFERRED TO AS CRITICAL HEIGHT.
3 COMPETITION INCLUDES ALL HARDWOODS EQUAL TO OR TALLER THAN ACCEPTABLE SOFTWOOD CRITICAL HEIGHT.

TABLE 2
DEVELOPMENT OF SELECTED 1976
PAPER POT PLANTATIONS ASSESSED 1986
10TH YEAR REPORT

SILVICULTURE TREATMENT NUMBER	PLANTATION NAME	AREA HA.	PLANTED SOFTWOOD		ALL NATURAL SOFTWOOD			ACCEPTABLE[2] NATURAL SOFTWOOD			ALL NATURAL HARDWOOD			NATURAL HARDWOOD COMPETITION[3]		
			AVG. HGT. (m)	AVG. DBH (cm)	AVG. DEN-SITY[1]	AVG. HGT. (m)	AVG. DBH. (cm)	AVG. DEN-SITY	AVG. HGT. (m)	AVG. DBH (cm)	AVG. DEN-SITY	AVG. HGT. (m)	AVG. DBH (cm)	AVG. DEN-SITY	AVG. HGT. (m)	AVG. DBH (cm)
101000776BP4	J.FERGUSON BK.	69	1.23	0.0	99	0.62	0.0	0	0.00	0.0	9732	3.99	3.9	9350	4.18	3.9
101001676BP1	CHARLO CAMP	74	2.74	4.5	1194	1.51	4.6	99	3.10	4.6	0	0.00	0.0	0	0.00	0.0
102T00176BP2	LOVALL'S LAKE	324	1.73	3.2	3730	2.93	4.7	597	3.39	5.0	1641	4.70	4.3	1641	4.70	4.3
102T00176BP2	LOVALL'S LAKE	324	1.71	3.6	3929	2.42	4.5	99	3.50	4.1	2711	5.41	4.9	2711	5.41	4.9
102T00576BP1	BROWSER LAKE	142	2.49	4.0	2417	1.66	4.2	358	3.41	4.3	7510	1.67	3.1	985	3.01	3.1
102T00776BP1	ORLO BROOK	146	3.37	4.7	7825	2.15	3.9	0	0.00	0.0	21353	2.19	4.2	1194	4.07	4.2
203T00976BP1	TOWER ROAD	33	3.30	4.5	879	2.31	4.5	199	4.06	5.0	199	1.82	3.9	33	4.32	3.9
203T00976BP2	SALMON BK	53	2.55	3.7	1691	1.52	6.0	199	3.44	6.0	0	0.00	0.0	0	0.00	0.0
203T00976BP3	COLD BROOK	53	2.31	4.0	3986	2.29	4.3	1762	3.28	4.4	526	1.36	0.0	0	0.00	0.0
203T00976BP5	BLACKVILLE TOWER	56	3.09	4.6	1542	1.63	5.0	99	3.53	6.7	50	1.08	0.0	0	0.00	0.0
204001276BP1	BARTIBOG	216	1.56	3.5	2735	2.46	5.0	1989	2.94	5.0	1790	1.27	0.0	0	0.00	0.0
306T00276BP1	EAST COY BROOK	42	3.89	4.8	398	1.48	0.0	0	0.00	0.0	1542	2.02	3.2	0	0.00	0.0
306T00376BP1	LAKE STREAM	20	3.87	5.4	1442	1.45	3.2	0	0.00	0.0	6789	2.53	4.0	547	4.96	4.2
306T01176BP1	EAST COY BROOK	43	4.01	5.2	1020	1.85	4.0	0	0.00	0.0	28698	2.42	3.3	821	4.57	3.1
306T01276BP1	EAST COY BROOK	12	4.74	6.3	1326	1.40	5.2	0	0.00	0.0	5570	1.83	0.0	0	0.00	0.0
307001776BP1	POINT WOLFE R	52	2.14	4.0	50	1.44	0.0	0	0.00	0.0	30239	1.91	0.0	7162	2.31	0.0
408T01076BP1	KESWICK RIVER	34	4.33	6.8	647	1.41	0.0	0	0.00	0.0	2387	4.41	4.9	796	6.26	4.9
408T01076BP1	KESWICK RIVER	59	3.17	4.6	1417	1.14	3.2	0	0.00	0.0	2561	1.55	0.0	0	0.00	0.0
510T00876BP1	MCFARLANE	80	1.43	3.5	83	1.14	3.4	0	0.00	0.0	4907	1.63	3.0	3531	1.92	3.0

1 DENSITY IN TREES PER HECTARE.
2 ACCEPTABLE IS DEFINED IN APPENDIX 9, PAGE 65 OF THE FOREST MANAGEMENT MANUAL. ALSO REFERRED TO AS CRITICAL HEIGHT.
3 COMPETITION INCLUDES ALL HARDWOODS EQUAL TO OR TALLER THAN ACCEPTABLE SOFTWOOD CRITICAL HEIGHT.

TABLE 3
SPECIES DEVELOPMENT OF SELECTED 1976
PLANTATIONS ASSESSED IN 1986
10TH YEAR REPORT

SILVICULTURE TREATMENT NO.	AREA HA.	PLANTED SOFTWOOD				METHOD OF SITE PREPARATION
		SPECIES	STOCK	HEIGHT(M)	D.B.H.(cm)	
101000776BP4	69	bS	PP	1.23	0.0	Burn
101001676BP1	74	jP	Pp	2.74	4.5	Shark Fin Barrels
102T00176BP1	324	bS	PP	1.73	3.2	Crusher
102T00176BP2	324	bS	PP	1.71	3.6	Crusher
102T00576BP1	142	jP	PP	2.49	4.0	Bracke
102T00776BP1	146	jP	PP	3.37	4.7	Crusher
103000476BP1	185	bS	BR	2.33	3.9	Finnish Plow
		jP	BR	3.51	5.6	Finnish Plow
203T00976BP1	33	jP	PP	3.30	4.5	Disc Trencher
203T00976BP1	53	jP	PP	2.55	3.7	Shark Fin Barrels
203T00976BP3	53	jP	PP	2.31	4.0	Shark Fin Barrels
203T00976BP4	45	jP	BR	2.57	4.2	Bracke
203T00976BP5	56	jP	PP	3.09	4.6	Shark Fin Barrels
204001276BP1	216	jP	PP	1.56	3.5	Shark Fin Barrels
306T00176BP1	107	jP	BR	3.37	4.8	Shark Fin Barrels
306T00276BP1	42	jP	PP	3.89	4.8	Shark Fin Barrels
306T00376BP1	20	jP	PP	3.87	5.4	Shark Fin Barrels
306T01176BP1	43	jP	PP	4.01	5.2	Shark Fin Barrels
306T01276BP1	12	jP	PP	4.74	6.3	Shark Fin Barrels
307001576BP1	87	bS	BR	2.12	3.6	Shark Fin Barrels
307001676BP1	126	bS	BR	2.61	4.1	Shark Fin Barrels
307001776BP1	52	bS	PP	2.14	4.0	Shark Fin Barrels
307T00476BP1	20	jP	BR	3.80	5.4	Shark Fin Barrels
406000176BP1	29	jP	BR	3.40	4.6	No-site Preparation
406000276BP1	13	jP	BR	3.78	4.9	No-site Preparation
408T01076BP1	34	jP	PP	4.33	6.8	Shark Fin Barrels
408T01076BP2	59	bS	PP	3.17	4.6	Shark Fin Barrels
509000976BP1	32	wS	BR	2.19	3.8	Root Rake
510001176BP1	25	wS	BR	2.21	4.1	Root Rake
510T00876BP1	40	bS	PP	1.33	3.3	Root Rake
		wS	PP	1.65	3.9	Root Rake
510T00876BP4	97	bS	BR	2.33	3.9	Root Rake
510T00876BP5	97	wS	BR	1.12	3.4	Root Rake

PP = paper pot; BR = bare root;
jP = jack pine; bS = black spruce; wS = white spruce

TABLE 4
LICENSE AVERAGES OF SELECTED 1976 PLANTATIONS
TEN YEARS AFTER PLANTING

LICENSE	STOCK TYPE	PLANTED SOFTWOOD HGT. (M)	PLANTED SOFTWOOD D.B.H. (CM)	BLACK SPRUCE HGT.	BLACK SPRUCE D.B.H.	WHITE SPRUCE HGT.	WHITE SPRUCE D.B.H.	JACK PINE HGT.	JACK PINE D.B.H.
UPSALQUITCH	PP	1.70	4.45	1.23	-	-	-	2.74	4.45
	ALL	1.70	4.45	1.23	-	-	-	2.74	4.45
NEPISIGUIT	PP	2.41	4.34	1.72	3.42	-	-	2.82	4.39
	ALL	2.41	4.34	1.72	3.42	-	-	2.82	4.39
LOWER MIRAMICHI	BR	2.81	4.81	2.33	3.87	-	-	2.91	4.90
	PP	2.73	4.35	-	-	-	-	2.73	4.35
	ALL	2.75	4.46	2.33	3.87	-	-	2.77	4.47
UPPER MIRAMICHI	PP	1.56	3.50	-	-	-	-	1.56	3.50
	ALL	1.56	3.50	-	-	-	-	1.56	3.50
QUEENS-CHARLOTTE	BR	3.49	4.77	-	-	-	-	3.49	4.77
	PP	4.25	5.66	-	-	-	-	4.04	5.42
	ALL	4.04	5.42	-	-	-	-	4.04	5.42
FUNDY	BR	2.89	4.92	2.25	3.82	-	-	3.80	5.44
	PP	2.14	4.03	2.14	4.03	-	-	-	-
	ALL	2.79	4.89	2.23	3.83	-	-	3.80	5.44
YORK	PP	3.48	5.27	3.17	4.59	-	-	4.33	6.79
	ALL	3.48	5.27	3.17	4.59	-	-	4.33	6.79
CARLETON	BR	2.19	3.84	-	-	2.19	3.84	-	-
	ALL	2.19	3.84	-	-	2.19	3.84	-	-
RESTIGOUCHE - TOBIQUE	BR	2.05	3.95	2.33	3.93	1.69	4.08	-	-
	PP	1.43	3.50	1.33	3.30	1.65	3.90	-	-
	ALL	1.96	3.94	2.16	3.92	1.68	4.07	-	-
PROVINCE	BR	2.50	4.60	2.31	3.90	1.84	3.99	3.31	4.96
	PP	2.85	4.94	1.88	4.40	1.65	3.90	3.17	4.98
	ALL	2.72	4.83	2.10	4.08	1.82	3.98	3.20	4.98

Stock Types - BR = Bare Root, PP = Paper Pot

TABLE 5

COMPARISON OF HEIGHT GROWTH
OF FIFTH AND TENTH YEAR ASSESSMENTS
BY SPECIES AND STOCK TYPE
FOR 1976 PLANTATIONS

ASSESSMENT PERIOD	BLACK SPRUCE		WHITE SPRUCE		JACK PINE	
	BR	PP	BR	PP	BR	PP
5th	0.84	0.56	0.64	0.48	1.08	1.06
10th	2.31	1.88	1.84	1.65	3.31	3.17
PERCENT INCREASE	175	236	188	244	206	199

TABLE 6

1976 PLANTATION PERFORMANCE BY LICENSE
TEN YEARS AFTER PLANTING

LICENSE	HECTARES SAMPLE	PERCENT OF AREA WITH ACCEPTABLE SOFTWOOD[2] DENSITY 1500 - 3000 TREES PER HECTARE	PERCENT OF AREA WITH HARDWOOD COMPETITION[4] MORE THAN 500 TREES PER HECTARE
UPSALQUITCH	143	100 (100)[3]	48
NEPISIGUIT	936	100 (0)	100
LOWER MIRAMICHI	240	787 (14)	77
UPPER MIRAMICHI	216	0 (0)	0
KENT	NS[1]	NS	NS
QUEENS-CHARLOTTE	266	100 (100)	25
FUNDY	285	100 (100)	93
YORK	93	100 (100)	37
CARLETON	32	100 (100)	100
RESTIGOUCHE-TOBIQUE	259	100 (100)	100
TOTAL	2470	89 (45)	76

[1]NS - no sample data available
[2]Acceptable softwood assumes a minimum of 1 500 planted trees and other softwoods except balsam fir which achieved critical height.
[3]Figures in brackets are for total softwood densities including balsam fir, exceeding 3 000 stems per hectare.
[4]Competition includes all hardwoods equal to or taller than acceptable softwood critical height.